



UNITED STATES DEPARTMENT OF COMMERCE  
Patent and Trademark Office

NOTICE OF ALLOWANCE AND ISSUE FEE DUE

MM22/0201

KENNETH A GANDY WOODARD EMHARDT  
NAUGHTON MORIARTY AND MCNETT  
BANK ONE TOWER SUITE 3700  
111 MONUMENT CIRCLE  
INDIANAPOLIS IN 46204-5137

| APPLICATION NO.       | FILING DATE | TOTAL CLAIMS                      | EXAMINER AND GROUP ART UNIT | DATE MAILED   |
|-----------------------|-------------|-----------------------------------|-----------------------------|---------------|
| 09/020,565            | 01/16/98    | 008                               | LEE, H                      | 2823 02/01/00 |
| First Named Applicant | LYDING,     | 35 USC 154(b) term ext. = 0 Days. |                             |               |

TITLE OF INVENTION FORMING OF DEUTERIUM CONTAINING NITRIDE SPACERS AND FABRICATION OF SEMICONDUCTOR DEVICES (AS AMENDED)

| ATTY'S DOCKET NO. | CLASS-SUBCLASS | BATCH NO.   | APPLN. TYPE | SMALL ENTITY | FEE DUE | DATE DUE           |
|-------------------|----------------|-------------|-------------|--------------|---------|--------------------|
| 0                 | 22010-428/IL   | 438-798.000 | H56         | UTILITY      | NO      | \$1210.00 05/01/00 |

**THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED.**

**THE ISSUE FEE MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED.**

**HOW TO RESPOND TO THIS NOTICE:**

I. Review the SMALL ENTITY status shown above.  
If the SMALL ENTITY is shown as YES, verify your current SMALL ENTITY status:

- A. If the status is changed, pay twice the amount of the FEE DUE shown above and notify the Patent and Trademark Office of the change in status, or
- B. If the status is the same, pay the FEE DUE shown above.

If the SMALL ENTITY is shown as NO:

- A. Pay FEE DUE shown above, or
- B. File verified statement of Small Entity Status before, or with, payment of 1/2 the FEE DUE shown above.

II. Part B-Issue Fee Transmittal should be completed and returned to the Patent and Trademark Office (PTO) with your ISSUE FEE. Even if the ISSUE FEE has already been paid by charge to deposit account, Part B Issue Fee Transmittal should be completed and returned. If you are charging the ISSUE FEE to your deposit account, section "4b" of Part B-Issue Fee Transmittal should be completed and an extra copy of the form should be submitted.

III. All communications regarding this application must give application number and batch number.  
Please direct all communications prior to issuance to Box ISSUE FEE unless advised to the contrary.

**IMPORTANT REMINDER: Utility patents issuing on applications filed on or after Dec. 12, 1980 may require payment of maintenance fees. It is patentee's responsibility to ensure timely payment of maintenance fees when due.**

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PS

| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. |
|-----------------|-------------|----------------------|---------------------|
| 09/020,565      | 01/16/98    | LYDING               | J 22010-128/IL      |

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EXAMINER

LEE, H

ART UNIT

PAPER NUMBER

2823

DATE MAILED:

02/01/00

#10

Please find below and/or attached an Office communication concerning this application or proceeding.

Commissioner of Patents and Trademarks

# Notice of Allowability

Application No.  
09/020,565

Applicant(s)

Lyding et al.

Examiner  
Hsien-Ming Lee

Group Art Unit  
2823



All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance and Issue Fee Due or other appropriate communication will be mailed in due course.

☒ This communication is responsive to January 3, 2000

☒ The allowed claim(s) is/are 40-46 and 50

☐ The drawings filed on \_\_\_\_\_ are acceptable.

☐ Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d).

☐ All ☐ Some\* ☒ None of the CERTIFIED copies of the priority documents have been

☐ received.

☐ received in Application No. (Series Code/Serial Number) \_\_\_\_\_

☐ received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

\*Certified copies not received: \_\_\_\_\_

☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).

A SHORTENED STATUTORY PERIOD FOR RESPONSE to comply with the requirements noted below is set to EXPIRE ~~THREE MONTHS~~ FROM THE "DATE MAILED" of this Office action. Failure to timely comply will result in ABANDONMENT of this application. Extensions of time may be obtained under the provisions of 37 CFR 1.136(a).

☐ Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL APPLICATION, PTO-152, which discloses that the oath or declaration is deficient. A SUBSTITUTE OATH OR DECLARATION IS REQUIRED.

☒ Applicant MUST submit NEW FORMAL DRAWINGS

☒ because the originally filed drawings were declared by applicant to be informal.

☐ including changes required by the Notice of Draftsperson's Patent Drawing Review, PTO-948, attached hereto or to Paper No. \_\_\_\_\_

☐ including changes required by the proposed drawing correction filed on \_\_\_\_\_, which has been approved by the examiner.

☒ including changes required by the attached Examiner's Amendment/Comment.

Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the reverse side of the drawings. The drawings should be filed as a separate paper with a transmittal letter addressed to the Official Draftsperson.

☐ Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Any response to this letter should include, in the upper right hand corner, the APPLICATION NUMBER (SERIES CODE/SERIAL NUMBER). If applicant has received a Notice of Allowance and Issue Fee Due, the ISSUE BATCH NUMBER and DATE of the NOTICE OF ALLOWANCE should also be included.

## Attachment(s)

☐ Notice of References Cited, PTO-892

☐ Information Disclosure Statement(s), PTO-1449, Paper No(s). \_\_\_\_\_

☐ Notice of Draftsperson's Patent Drawing Review, PTO-948

☐ Notice of Informal Patent Application, PTO-152

☒ Interview Summary, PTO-413

☒ Examiner's Amendment/Comment

☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material

☒ Examiner's Statement of Reasons for Allowance

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***EXAMINER'S AMENDMENT***

1. An extension of time under 37 CFR 1.136(a) is required in order to make an examiner's amendment which places this application in condition for allowance. During a telephone conversation conducted on *January 24, 2000*, *Kenneth A. Gandy* requested an extension of time for ONE MONTH and authorized the Commissioner to charge Deposit Account No. 233030 the required fee for this extension and authorized the following examiner's amendment. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.

2. The application has been amended as follows:

In specification, page 12, line 7, changes " device 12" into -- device 11--.

Changes the Title from " Semiconductor Devices, and Method for Same" to -- Forming of Deuterium Containing Nitride Spacers and Fabrication of Semiconductor Devices--.

***Reasons for Allowance***

3. Claims 40-46 and 50 are allowed.

4. The following is an examiner's statement of reasons for allowance:

The prior art of record, Lisenker et al., National Semiconductor ( submitted by applicant ), teach a method for conditioning a semiconductor device to increase its resilience to hot carrier

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effects, comprising passivating the device with molecular deuterium comprises deuterium gas and nitrogen ( page 4, line 30; page 8, line 29 through page 9, line 1; and page 9, lines 15-25 ) in an area of the device subject to hot carrier effects; and heating the device ( page 4, line 30 ); wherein the semiconductor device includes a silicon layer and an insulative layer ( silicon oxide ) adjacent the silicon layer ( page 6, lines 32-35 ); the deuterium ambient includes 1% to 100% by volume deuterium gas ( page 14, claim 17 ); heating the device at a temperature of about 500C in a deuterium ambient ( page 9, lines 15-22); and the device includes at least one metal oxide semiconductor ( MOS ) transistor ( page 11, lines 5-8 ).

However, the applied reference neither teaches nor suggests *an ammonia compound with a silane compound, wherein at least one of the compound contains deuterium to form a silicon nitride spacer containing deuterium*, wherein the fabricating includes reacting a compound of the formula  $\text{ND}_{(n)}\text{H}_{(3-n)}$  (  $n = 1, 2, \text{ or } 3$  ) with a silane compound, and the silane compound is encompassed by the formula  $\text{SiD}_{(m)}\text{H}_{(4-m)}$  (  $m = 1, 2, 3 \text{ or } 4$  ), or  $\text{Si}_2\text{D}_o\text{H}_p\text{X}_q$  (  $o = 1, 2, 3, 4, 5, \text{ or } 6$ ;  $p = 0, 1, 2, 3, 4, \text{ or } 5$ ;  $q = 0, 1, 2, 3, 4, 5$ ; and X is halogen, with the proviso that  $o + p + q = 6$  ).

With the presence of silicon nitride above the interface of semiconductor and insulative layer in the process of deuterium-treated semiconductor device, the undesirable diffusion of deuterium gas to the interface can be prevented while treating the semiconductor device with deuterium for improving hot carrier reliability.

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5. Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

*Areas of Search*

438/38, 509, 522, 530, 798, 974; 257/607.

6 Any inquiry concerning this communication or earlier communications from the examiner should be directed to Hsien-Ming Lee whose telephone number is (703) 305-7341. The examiner can normally be reached on Monday-Friday from 7:30 AM to 4:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wael Fahmy, can be reached on (703) 308-4918. The fax phone number for this Group is (703) 305-3432.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Group receptionist whose telephone number is (703) 308-0956.

*Lee*

Hsien-Ming Lee  
Examiner Group 2823  
January 24, 2000

*Charles D. Bowers Jr.*

Charles Bowers  
Supervisory Patent Examiner  
Technology Center 2800